

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a semiconductor substrate on which a semiconductor element is formed;

5 a multilayer metal wiring layer having a plurality of layers stacked on the semiconductor substrate respectively via interlayer dielectric films;

a capacitor comprising first and second elements, each of the elements including a lower metal electrode, a dielectric film, and an upper metal electrode stacked  
10 formed on the multilayer metal wiring layer via an interlayer insulation film; and

first and second wiring layers of an upper layer formed on an insulation film, the insulation film being  
15 formed so as to cover the capacitor,

wherein the upper metal electrodes of the first and second elements have substantially the same area,

the upper metal electrode of each of the elements is provided within an area in which the lower metal electrode and the dielectric film of said each element  
20 are stacked, and

the lower metal electrode of the first element and the upper metal electrode of the second element are electrically connected to each other, and the upper  
25 metal electrode of the first element and the lower metal electrode of the second element are electrically connected to each other.

2. The semiconductor device according to claim 1,  
wherein the lower metal electrode of the first element  
and the upper metal electrode of the second element are  
electrically connected to each other by the first  
5 wiring layer, and the upper metal electrode of the  
first element and the lower metal electrode of the  
second element are electrically connected to each other  
by the second wiring layer.

3. The semiconductor device according to claim 1,  
10 wherein the dielectric film of each of the first and  
second elements of the capacitor comprises stacked  
films including a first film made of a high dielectric  
constant material and a second film made of a material  
having a low leakage current.

4. The semiconductor device according to claim 3,  
15 wherein the first film contains at least one of  $Ta_2O_5$ ,  
 $Nb_2O_3$ ,  $ZrO_2$ ,  $HfO_2$ ,  $La_2O_3$  or  $Pr_2O_3$ , and the second film  
contains at least one of  $Al_2O_3$ ,  $SiO_2$  or  $SiN$ .

5. The semiconductor device according to claim 3,  
20 wherein the lower metal electrode of each of the first  
and second elements is made of  $TiN$ , and the upper metal  
electrode of each of the first and second elements is  
made of  $TiN$ .

6. The semiconductor device according to claim 1,  
25 wherein the dielectric film of each of the first and  
second elements of the capacitor comprises stacked  
films including a first film made of a high dielectric

constant material and second and third films made of a material having a low leakage current, the second and third films interposing the first film therebetween.

7. The semiconductor device according to claim 3,  
5 wherein the first film contains at least one of Ta<sub>2</sub>O<sub>5</sub>, Nb<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub>, HfO<sub>2</sub>, La<sub>2</sub>O<sub>3</sub> or Pr<sub>2</sub>O<sub>3</sub>, and each of the second and third films contains at least one of Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> or SiN.

8. The semiconductor device according to claim 6,  
10 wherein the lower metal electrode of each of the first and second elements is made of TiN, and the upper metal electrode of each of the first and second elements is made of TiN.

9. The semiconductor device according to claim 6,  
15 wherein the first film and the second film have different thickness.

10. The semiconductor device according to claim 1,  
wherein the dielectric film of each of the first and second elements comprises a high dielectric constant  
20 material having a relative dielectric constant of at least 20.

11. The semiconductor device according to claim 10, wherein the high dielectric constant material contains at least one of Ta<sub>2</sub>O<sub>5</sub>, Nb<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub>, HfO<sub>2</sub>,  
25 La<sub>2</sub>O<sub>3</sub> or Pr<sub>2</sub>O<sub>3</sub>.

12. A semiconductor device comprising:

a semiconductor substrate on which a semiconductor

element is formed;

a multilayer metal wiring layer having a plurality of layers stacked on the semiconductor substrate respectively via interlayer dielectric films;

5 a dielectric film formed over the semiconductor substrate so as to cover the multilayer metal wiring layer;

first and second upper metal electrodes formed on the dielectric film, the first and second upper metal electrodes having substantially the same area; and

10 first and second wiring layers of an upper layer formed on an insulation film, the insulation film being formed so as to cover the first and second upper metal electrodes and the dielectric film,

15 wherein a capacitor is formed of first and second elements,

the first element comprises the first upper metal electrode, the dielectric film, and a first lower metal electrode formed of a part of an uppermost wiring layer of the multilayer metal wiring layer,

20 the second element comprises the second upper metal electrode, the dielectric film, and a second lower metal electrode formed of another part of the uppermost wiring layer of the multilayer metal wiring layer,

25 the first upper metal electrode is provided within an area in which the first lower metal electrode and

the dielectric film are stacked,

the second upper metal electrode is provided within an area in which the second lower metal electrode and the dielectric film are stacked, and

5 the first lower metal electrode of the first element and the second upper metal electrode of the second element are electrically connected to each other, and the first upper metal electrode of the first element and the second lower metal electrode of the  
10 second element are electrically connected to each other.

13. The semiconductor device according to claim 12, wherein the first lower metal electrode of the first element and the second upper metal electrode  
15 of the second element are connected to each other by the first wiring layer of the upper layer, and the first upper metal electrode of the first element and the second lower metal electrode of the second element are connected to each other by the second wiring layer  
20 of the upper layer.

14. The semiconductor device according to claim 12, wherein the dielectric film of each of the first and second elements comprises a high dielectric constant material having a relative dielectric constant  
25 of at least 20.

15. The semiconductor device according to claim 14, wherein the high dielectric constant material

contains at least one of  $\text{Ta}_2\text{O}_5$ ,  $\text{Nb}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{HfO}_2$ ,  $\text{La}_2\text{O}_3$  or  $\text{Pr}_2\text{O}_3$ .

16. The semiconductor device according to claim 12, wherein the upper layer constituting the first and second metal layers is made of Cu.

17. The semiconductor device according to claim 1, wherein the multilayer metal wiring layer comprises at least two metal wiring layers.

18. The semiconductor device according to claim 1, wherein an analog circuit is formed in the semiconductor substrate, and the capacitor is included in the analog circuit.

19. The semiconductor device according to claim 18, wherein the analog circuit includes an analog/digital converter.